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A METHOD FOR CALCULATING AND EXPRESSING THE CONCENTRATION OF INSECTICIDAL CHEMICALS IN SOLUTIONS

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The concentration of an insecticidal chemical in a solution may be expressed in several ways. In formulations sold in interstate commerce under the Federal Insecticide Act it is expressed on a weight/ weight (percent) basis. In test formulations other bases sometimes used are volume/volume, weight per volume of solvent, and weight per volume of formulation. Often the basis on which the formulation is expressed is not made clear. Units from both the U.S. and metric systems are sometimes used in a single formulation.

Volumes of insecticidal solutions are often measured in metric units for laboratory tests and in U.S. units for field use. When the effectiveness of several chemicals or of a given chemical in various formulations is compared, it is helpful if the concentrations of sprays can be expressed in convenient units of both systems. A lack of clearness or of a uniform basis of expression may be a source of error, or it may be difficult to measure predetermined doses for such comparisons. A method for calculating and expressing the concentration of an insecticidal chemical on both weight per volume of formulation and weight/weight (percent) bases, in convenient metric or U.S. units, is described in this paper.

A test formulation in the developmental stage is prepared in a tared 100-ml. graduated cylinder at room temperature (68° F.). The insecticidal chemical and the other components, except the solvent, are transferred to the cylinder, which is weighed in grams after each transfer. Solvent is added, and when all the components are in solution more solvent is added to make up to the 100-ml. mark. The filled cylinder is weighed and the weight of the solvent obtained by difference.

Weights in grams per 100 ml. may be converted to pounds per gallon by dividing by 12. The factor is derived by dividing 453.6, the number of grams in a pound, by 3785.3, the number of milliliters in a gallon, multiplying by 100, the number of milliliters in the test formulations, and rounding the product slightly. The density in grams per milliliter and percent by weight are obtained by calculation.

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When a formulation is ready for large-scale use and specifications on the weight/weight (percent) basis are required, the percentages derived from the test formulation are rounded to convenient units.

A formulation for an ethylene dibromide-chlordane dip developed as outlined above and expressed on several bases follows:

Ingredient	Test formulation			Specification formulation, weight/weight
	Quantities used	Calculated values		
		Weight/volume	Weight/weight	
	Grams/100 ml.	Pounds/gallon	Percent	Percent
Ethylene dibromide	12	1.00	13.08	13.0
Chlordane	6	.50	6.54	6.5
Cellosolve	6	.50	6.54	6.5
Tween 20	6	.50	6.54	6.5
Isopropyl alcohol	61.7 (by diff.)	5.14	67.28	67.5

The specification formulation weighed 91.5 grams per 100 ml., or 7.63 pounds per gallon, at 68° F.

When conversions are made from one basis of expression to another and figures are rounded, slight discrepancies are unavoidable, but they are not considered important with reference to the effectiveness of the formulation for insect control.

It is believed that the adoption of this method as a standard for expressing the concentration of insecticidal chemicals in solutions will facilitate laboratory testing, the establishment of dosage schedules in large-scale use, and the preparation of specifications on several bases, including weight/weight (percent). For laboratory testing the method provides for the measurement by volume of predetermined weights of a chemical expressed in metric units selected with reference to equivalent U.S. units convenient for large-scale use. For example, a formulation may contain 24 grams of an insecticidal chemical per 100 ml., or 1.2 grams per 5 ml. This is equivalent to 2 pounds of the chemical per gallon, or 1 pound per 1/2 gallon. When 5 ml. of such a formulation is diluted to make 1 liter of spray or when 1/2 gallon is diluted to make 100 gallons of spray, the concentrations of the sprays are equivalent.

When specifications on a weight/weight (percent) basis are required, the method provides, with a little rounding, all the data necessary for their preparation. It is suggested that such specifications include the approximate weight in pounds of insecticidal chemical per gallon or the weight of 1 gallon of the formulation at 68° F.

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